REMARKS/ARGUMENTS

In the Office Action dated June 4, 2008, claims 1 - 5, 7 - 11, 15 - 19, and 21 were rejected under 35 U.S.C. Section 103(a) as unpatentable over Qin, U.S. Patent Publication 2005/0283072 in view of Lin, U.S. Patent 6,068,597. Reconsideration of the claims in view of the amendments and the following remarks is respectfully requested.

Telephone Interview

The Applicants thank the Examiner for the telephone interview of July 16, 2008. In this interview, the finality of the office action was discussed, and it was agreed that, because new references were cited in the rejection, the rejection should be non-final.

Amendments

As recited in independent claims 1, 10, and 15, in the present invention, an ultrasound wave is directed into a tissue or medium. The ultrasound wave induces a vibration, which can then be used to quantify a property of elasticity based on resonant frequencies. To clarify that the ultrasound wave induces the vibration, independent claims 1, 10, and 15 have been amended. This amendment is not required to differentiate the claims as filed from the cited references, but is made to more clearly state the use of the ultrasound wave.

The Prior Art References

As discussed above, all of the pending claims are presently rejected based on the combination of Qin and Lin.

Qin discloses a method for calculating bone mineral density and material strength/stiffness. An ultrasound wave is directed <u>through</u> a bone specimen from a first transducer 12 to a second transducer 14. (See Fig. 1a; paragraph 46; paragraph 56) A computer 22 calculates <u>propagation times</u> of signals transmitted through the bone, calculates <u>propagation velocity</u> through the bone, and other parameters. (Paragraph 64) These

parameters are used in mathematical equations, and particularly in a regression analysis (paragraphs 68 - 80) which related measured values of the propagation velocity to stiffness.

Lin discloses a system which used ultrasonic Doppler spectrometry to produce a vibrational resonance spectra of tissues. In this system, a variable frequency tone generator 124 produces a waveform, which is provided to a pair of audio transducers 112. The <u>audio transducers</u> induce vibrations into a medium or tissue to be scanned (Col. 4, lines 52 - 60), at frequencies distributed between 10 and 350 Hz (Col. 4, lines 66 - 67).

After a vibration is induced, an ultrasound transducer produces ultrasonic waves which are directed within the medium, and Doppler signal processing is used to detect frequency shifts in the returning echoes. The spectrometer examines the Doppler amplitude variation as a function of the stimulus frequency, and provides a vibrational resonance spectral "signature" curve for the material or tissue being imaged. (Col. 5 lines 47 - 49) This "signature" curve is a "multi-peak" resonance spectrum (Col. 7, lines 5 - 11). The acquired spectral data is used to provide a two dimensional image which can be used, for example, to detect and differentiate tumors. (Abstract)

<u>Independent Claim 1</u>

As recited in claim 1, the present invention provides a method for characterizing an elasticity property of a viscous medium. The method comprises directing <u>an ultrasound wave</u> in the viscous medium to <u>produce a vibrational force</u> on the medium, determining a vibrational velocity of the medium as a function of the frequency of vibration, and repeating these steps for a plurality of frequencies to develop a resonance spectrum of the medium. Subsequently, a <u>resonant frequency</u> of the viscous medium is determined, and the <u>elasticity property</u> is determined as a function of the resonant frequency.

The cited Qin and Lin references do not disclose all of the elements of claim 1, either alone or in combination. Neither cited reference discloses the use of an ultrasound wave to produce a vibrational force on the medium. Qin, rather, discloses directing an ultrasound wave through a bone, and calculating time and velocity parameters of the propagation of the wave through the bone. Qin fails to disclose producing any vibrational force, and, in fact fails to discuss any vibration.

Lin induces a vibration using a plurality of acoustic transducers. The ultrasound transducer does not produce a vibration, but rather provides a pulsed Doppler beam, which reflects or echoes signals for determining a Doppler shift.

Neither of the cited references, moreover, discloses determining an elasticity property of the tissue as a function of the resonant frequency. Qin, as discussed above, does not induce a vibration, and does not produce a resonance spectrum at all. Lin produces a multi-peak resonance spectrum based on Doppler shift data, and uses this spectrum to reconstruct an image. Lin does not correlate resonant frequency with an elasticity parameter. Therefore, the cited references do not disclose all of the elements of claim 1, either alone or in combination, and the Applicants respectfully request that the rejection of claim 1 and associated dependent claims be withdrawn.

Independent Claim 10

Independent claim 10 recites directing an ultrasound wave operating at a first oscillating frequency at a focal point in the tissue, measuring a vibrational velocity of the tissue at the focal point, and varying the oscillating frequency over a range selected to produce a resonant frequency response in the tissue. The resonant frequency is then correlated to a known elasticity parameter.

Again, neither of the cited references discloses the use of an ultrasound wave to induce a vibration in tissue. Qin, as discussed above, does not disclose a vibration at all. Lin uses an acoustic transducer to induce a vibration.

Neither of the cited references discloses inducing the vibration at a specific focal point. Qin, again, fails to induce a vibration at all. Lin employs multiple audio transducers which are directed at a medium to be studied. These transducers are directed at the medium in general, and not at any particular point within the medium to be imaged. As a result, the resonance is global through the medium, and is affected by the shape and size of the object as well as the material properties. Therefore, elasticity parameters cannot be quantitatively resolved using this method.

Neither of the cited references, furthermore, discloses correlating a resonant frequency with a known elasticity parameter. Qin, as discussed above, does not determine a resonant frequency at all. Lin produces a characteristic curve which can include a number of resonant frequencies, and uses this data to produce images.

Claim 10, therefore, cannot be obvious in view of the cited references, and the applicants respectfully request that the rejection of claim 10 and associated dependent claims be withdrawn.

Independent Claim 15

Claim 15 is directed to an apparatus for determining an elasticity property of a viscous medium. The apparatus comprises an ultrasound transducer for applying an ultrasound beam operating at a selectively varying frequency at the viscous medium, and a detector for measuring a velocity and a frequency of vibration of the medium. A processing unit drives the ultrasound transducer at varying frequencies over a selected frequency range, receives the velocity and frequency of vibration from the detector; and determines a resonant frequency at

selected positions within the medium. The processing unit determines a shear elasticity or a shear viscosity as a function of the resonant frequency.

As discussed above, neither of the cited references discloses the use of an ultrasound wave to induce a vibration in tissue. Neither of the cited references discloses correlating a resonant frequency with a known elasticity parameter. As the cited references fail to disclose all of the elements of the claim, claim 15 cannot be obvious in view of the cited references, and the applicants respectfully request that the rejection of claim 15 and associated dependent claims be withdrawn.

New Claim 22.

New claim 22 depends from claim 1 and clarifies that the frequency of vibration caused by the vibrational force is varied between zero and eight kilohertz. New claim 22 further differentiates the invention from the cited Lin reference which, as discussed above, applies a vibration in a significantly lower frequency range, between ten and 350 hertz.

Conclusion

In view of the foregoing amendments and remarks, the Applicants submit that claims 1 - 22 are in condition for allowance, and respectfully request that a notice of allowance fore these claims be issued.

The Commissioner is authorized to charge any fees under 37 CFR § 1.17 that may be due on this application to Deposit Account 17-0055. The Commissioner is also authorized to treat this amendment and any future reply in this matter requiring a petition for an extension of time as incorporating a petition for extension of time for the appropriate length of time as provided by 37 CFR § 136(a)(3).

Respectfully submitted,

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By:____________________

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